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Assessing the vulnerability of Norwegian forested landscapes to extreme wind speeds using the ForestGales model

Morgane Merlin¹, Peter Zubkov¹, Kathrin Sunde², Nicolas Cattaneo¹, Svein Solberg¹, and Rasmus Astrup¹

¹NIBIO, Ås, Norway

²eSmartSystems, Halden, Norway

In Europe, more than half of all the damages to forest by volume results from windstorms. In Norway, forests cover more than a third of the country's land surface, and are important economically, culturally, and socially. Storm damage can have a range of consequences for the forestry industry and society including dangerous forest operations, reduced wood quality, reduced timber prices, electric outages, and increased risk for bark beetle outbreaks. It is crucial for all the actors in the forestry sector to understand wind damage. The recent storm of November 19th, 2021 highlighted this need and provided a unique opportunity to assess the research tools at our disposal to model wind damage risk in Norwegian forests.

One of these tools is the model ForestGales developed by the UK Forest commission to predict critical wind speeds for damage in a forest stand. The critical wind speed is a common measure of a tree's susceptibility to wind damage, defined as the wind speed that would cause tree failure due to wind, either by uprooting or breakage of the trunk at 1.3 m high. Used together with models describing the extreme wind speed distribution over a region, probabilities of wind damage can be drawn at the individual tree or forest stand level. The ForestGales model was modified to suit Norwegian conditions using the current available data and applied to two different situations:

- Trees along powerlines. Tree failure can lead to powerline failure with potentially severe economic and social consequences. In this context, the ForestGales model could provide a tool to identify the risk trees and adapt management accordingly. We used the model on several sites along powerlines in the southern Norway and assessed its efficiency in predicting tree falls between summer 2020 and summer 2021, without any major storm events.
- the Norwegian forest resource map SR16. The 16 x 16 m map product contains information relative to tree species, height, volume and biomass and is useful in large-scale analyses of the forest resources in the country. Using ForestGales on the SR16 map product would enable us to assess the fine-scale risk of wind damage over the entire country and inspect the impacts of changed forest structure following climate change and/or changes in forest management on the forest vulnerability to wind damage. The mapped damage from the storm of November 19th, 2021 will provide a unique opportunity to apply and test the validity and accuracy of the ForestGales model in Norway after a storm.

